UNIVERSITY OF SASKATC
MIDTERM EXAMINATION

EE 486.3/402.3 Microwave Engineering

Professor: Dr. D. M. Klymyshyn February 28, 2002
Time: **80 minutes**
Notes: One formula sheet is allowed.
2-port parameter conversion sheet is allowed.
All 3 questions are of equal value.
Assume all transmission lines are lossless.

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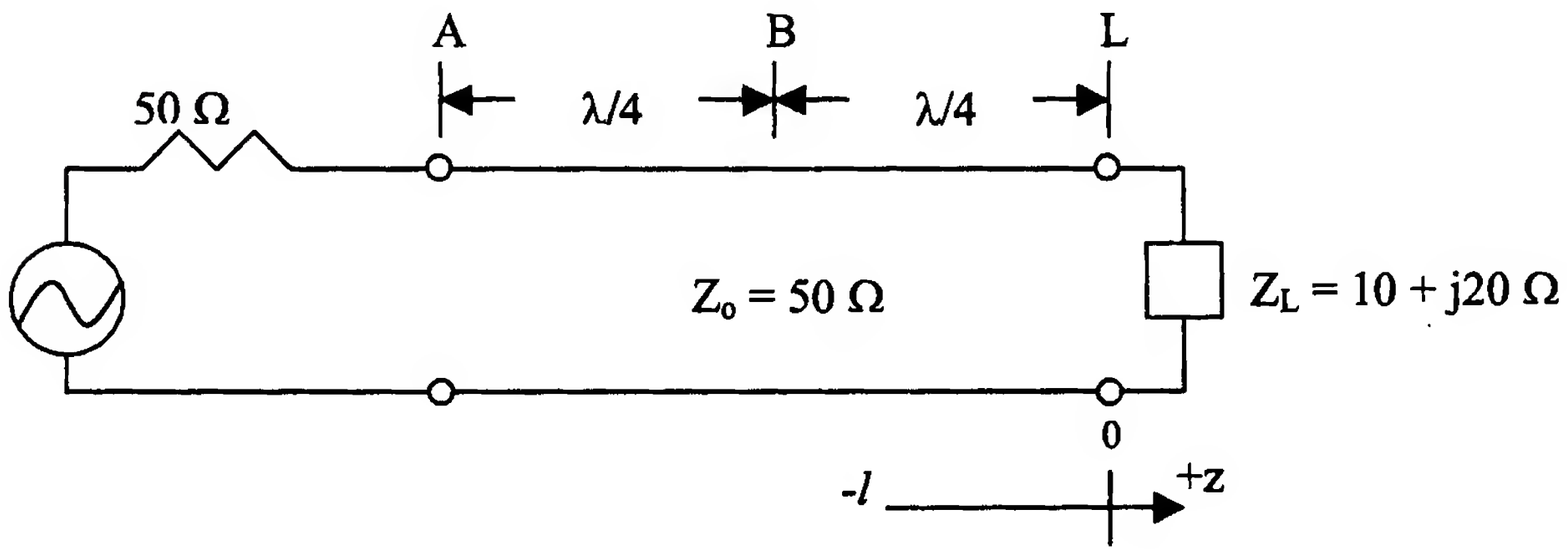
1. A microwave circuit is shown. The power **available** from the source (P_{avs}) is 0 dBm. Using **transmission line equations** (not the Smith Chart), find the following:

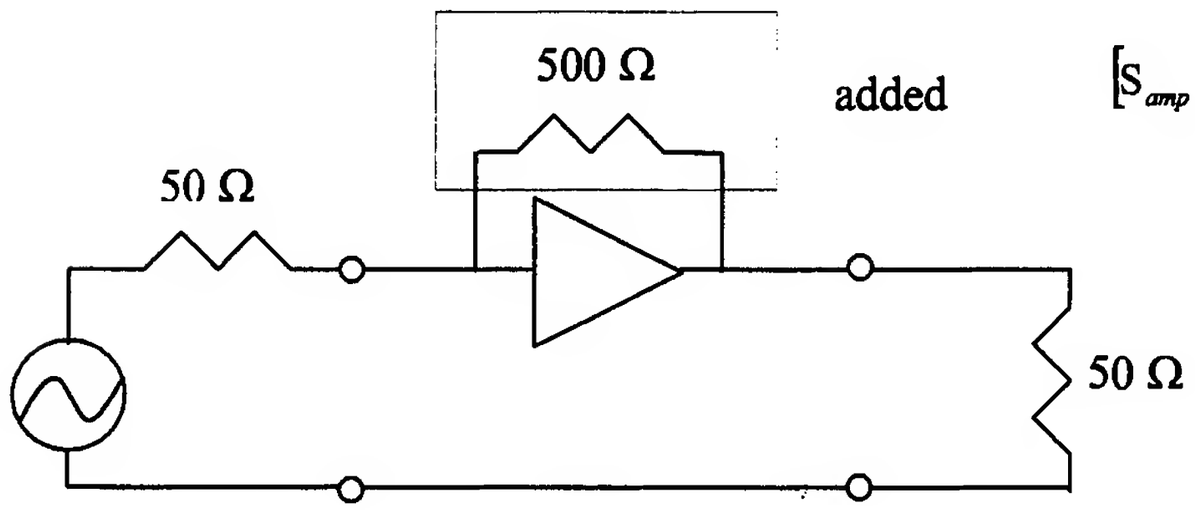
   a. $|V|$ at points A, B, and L.

   b. **Average power** at points A, B, and L using $\frac{1}{2}\left|\frac{V(-l)}{Z(-l)}\right|^2 \mathrm{Re}\left(Z(-l)\right)$.



2. The [S] parameters of the amplifier **alone** as measured in a 50 Ω system are given. A resistor is added to the amplifier as shown. Does this **increase** or **decrease** the **power gain** (note: **not** voltage gain) of the overall 2-port network and by how much?

(**HINTS**: The power gain of a 2-port network with source and load terminated in Z_o is 20 log $|S_{21}|$. [Y] parameters of the amplifier **alone** are also given.)



$$[S_{amp}] = \begin{bmatrix} 0.82\angle 0° & 0 \\ 3.41\angle 0° & 0.5\angle 180° \end{bmatrix}$$

$$[Y_{amp}] = \begin{bmatrix} 0.002 & 0 \\ -0.15 & 0.06 \end{bmatrix}$$

3. Design an **open circuit single shunt** stub tuner to match a 100 Ω load to a 50 Ω line. The stub should be as **close as possible** to the load. Use 50 Ω transmission lines for the tuner. Include the **Smith Chart** provided with your solution, **clearly** marking all constructions.